EXECUTIVE SUMMARY

The Ernest Orlando Lawrence Berkeley National Laboratory (Berkeley Lab) is currently in the Corrective Measures Study (CMS) phase of the Resource Conservation and Recovery Act (RCRA) Corrective Action Process (CAP). A CMS Plan was prepared by Berkeley Lab (Berkeley Lab, 2002a) and approved by the California Environmental Protection Agency (Cal-EPA), Department of Toxic Substance Control (DTSC) on June 18, 2002 (DTSC, 2002). The CMS Plan established the requirements and procedures to be used for completing the CMS. This report describes the results of the CMS, which was conducted in accordance with that approved plan. The purpose of the CMS Report is to recommend appropriate remedies that can eliminate or reduce potential risks to human health from anthropogenic chemicals in soil and groundwater, and protect groundwater and surface water quality under provisions of the Porter-Cologne Water Quality Control Act (Division 7 of the California Water Code).

The Ecological Risk Assessment (ERA) (Berkeley Lab, 2002b) concluded that there are currently no hazards to ecological receptors (plants or animals). The Human Health Risk Assessment (HHRA) (Berkeley Lab, 2003a) identified the chemicals of concern (COCs) at Berkeley Lab as volatile organic compounds (VOCs) and polychlorinated biphenyls (PCBs). Risks from these chemicals were estimated by calculating theoretical incremental lifetime cancer risks (ILCRs) and non-cancer hazard indices (HIs), assuming an industrial/institutional land use scenario. This scenario is consistent with the current and potential future land use at Berkeley Lab. These calculated measures of risk were compared to established threshold values. The theoretical ILCRs were compared to the United States Environmental Protection Agency (USEPA) target cancer risk range of 10^{-4} to 10^{-6}, which is considered by the agency to be safe and protective of public health [Federal Register 56(20): 3535, Wednesday, January 30, 1991]. Exposure to chemicals with a Hazard Index (HI) below 1.0 is considered unlikely to result in adverse non-cancer health effects over a lifetime of exposure, so the calculated HIs were compared to this value. The HHRA also addressed protection of beneficial uses of groundwater by comparing COC concentrations to drinking water standards. Based on these comparisons, the HHRA recommended that four areas of soil contamination and eleven areas of groundwater contamination should be further evaluated in the CMS.

The initial step in the evaluation process was development of Corrective Action Objectives. The objectives were developed based on both risk-based and regulatory-based criteria. The primary Corrective Action Objective, which is risk based, is to reduce COC concentrations, so that theoretical ILCRs are less than, or at the lowest reasonably achievable level within the USEPA target range for risk managers (between 10^{-4} and 10^{-6}) and HIs are less than 1. Although an ILCR anywhere within the USEPA target range for risk managers (also referred to as the "risk management range" is considered to be safe and protective of public health, the lowest reasonably achievable level within the risk management range was selected as the risk-based Corrective Action Objective for the following reasons:

1. The USEPA has expressed a preference for cleanups achieving the more protective end of the risk range (i.e., 10^{-6}) (USEPA, 1997).

2. The DTSC has also expressed a preference for the cleanup achieving the more protective end of the risk range (i.e., 10^{-6}), if reasonably achievable. The required cleanup levels will be specified by the Standardized Permits and Corrective Action Branch of the DTSC in a modification to Berkeley Lab's RCRA Hazardous Waste Handling Facility Permit.

3. Institutional controls will be required for those areas where the theoretical ILCR>10^{-6} and/or HI>1. These controls would result in added costs for new building construction and possibly preclude development in some areas.

The following Corrective Action Objectives were developed based on regulatory requirements that address concerns other than direct exposure pathways to workers at Berkeley Lab:

- Protect and/or restore groundwater quality to levels that are protective of beneficial uses.

- Control the migration of contaminated groundwater so that COCs do not migrate to groundwater in adjacent uncontaminated areas or to surface water.

- Control the migration of contaminated groundwater so that COCs above risk-based levels do not migrate to groundwater in adjacent areas where concentrations are below risk-based levels.

These objectives were selected for the following reasons:

1. They are California state requirements specified in Resolutions of the SWRCB under the Porter-Cologne Water Quality Control Act.

2. Institutional controls will be required for those areas where the groundwater is considered a potential drinking water source and MCLs are exceeded.

There are various costs and benefits associated with compliance or non-compliance with the risk-based and regulatory-based objectives listed above. Cleanup to less stringent risk-based levels (e.g., 10^{-4} or 10^{-5} rather than 10^{-6}) would be less expensive and would still be in the range that is considered safe and protective of public health. However, less stringent cleanup levels would result in added costs for new building construction and would possibly preclude development in some areas. In addition, there would likely be a negative impact on the value of the property. Less stringent risk-based levels would also adversely affect the project schedule and incur additional costs since they would require negotiation with the regulatory agencies. Non-compliance with the regulatory-based objectives or risk-based objectives required by the regulatory agencies could result in enforcement actions and resultant legal costs.

Media Cleanup Standards (MCSs) were developed to address both the risk-based and regulatory-based Corrective Action Objectives. Two sets of risk-based MCSs were developed for VOCs: the first set, the target risk-based MCSs, was based on theoretical ILCRs of 10^{-6} and non-cancer HIs of 1; the second set, the upper-limit risk-based MCSs, was based on theoretical ILCRs of 10^{-4} and non-cancer HIs of 1.

Regulatory-based MCSs associated with protection of potential future drinking water sources are considered applicable in areas of Berkeley Lab where the groundwater meets SWRCB well yield criteria (>200 gallons per day) for potential drinking water sources. MCSs for groundwater in those areas were set at MCLs for drinking water. Regulatory-based MCSs for VOCs in soil in those areas were set at levels that would protect groundwater from adverse impacts that could potentially result in COC concentrations exceeding MCLs. MCLs are also considered to be applicable long-term goals for all groundwater at Berkeley Lab.

In addition to MCSs, a compliance level of non-detect was set for areas of groundwater and surface water that are not currently contaminated, but could potentially be impacted by migration of COCs. This addresses the SWRCB non-degradation policy (Resolution 68-16) under the Porter-Cologne Water Quality Control Act.

Potential corrective measures alternatives that could meet the Corrective Action Objectives were identified. The alternatives were selected from the following general categories:

- No Action
- Risk and Hazard Management
- Monitored Natural Attenuation
- Containment and Hydraulic Control
- Active Treatment/Disposal.

The corrective measures alternatives that were recommended for implementation were developed from the list of identified technologies using the following procedure:

1. Selection of technologies that are potentially applicable to the COCs (VOCs and PCBs).

2. Preliminary screening of those alternatives based on potential applicability and effectiveness in achieving MCSs and/or protecting human health under site-specific conditions.

3. Evaluation of retained alternatives to assess whether they could potentially meet the following standards:

   - Protect human health and the environment
   - Comply with applicable standards for the management of waste
   - Attain MCSs
   - Control migration (if applicable)

4. Development of the specific Corrective Action Objectives that are applicable at each area of groundwater or soil contamination.

5. Evaluation of the retained alternatives that could potentially meet the area-specific Corrective Action Objectives using the following decision factors:

   - Long-term reliability and effectiveness
   - Reduction of toxicity, migration potential, or volume of the COCs
   - Short-term effectiveness
   - Cost.

6. Recommendation of corrective measures for implementation.

Based on the screening process, the following technologies were retained for the site-specific evaluations applied to each of the areas of soil and groundwater contamination.

Soil

- No Action
- Institutional Controls
- Containment (Capping, Solidification, Stabilization)
- Chemical Oxidation
- Soil Vapor Extraction (SVE) or Dual Phase Extraction (DPE)
- Thermally Enhanced SVE/DPE
- In Situ Soil Flushing (with water)
- Soil Mixing
- Excavation with offsite disposal.

Groundwater

- No Action
- Monitored Natural Attenuation (plume core and periphery zones)
- Institutional Controls
- Containment (slurry walls, sheet pile walls, grout curtains)
- Groundwater capture (drains, trenches, extraction wells)
- Permeable Reactive Barrier and Funnel and Gate
- Chemical Oxidation
- Enhanced Bioremediation
- Groundwater Extraction/Flushing
- Dual-Phase (groundwater and soil-vapor) Extraction.

Where cleanup of solvent-contaminated groundwater to MCSs is demonstrated to be technically impracticable, provision is made for developing an alternative remedial strategy protective of human health and the environment.

The following table describes the specific corrective measures alternative recommended for implementation at each area of soil and groundwater contamination included in the CMS. The potential human receptors of concern and exposure pathways for which COC concentrations currently exceed target risk-based MCSs are also provided in the table. In addition, regulatory compliance issues are noted where applicable. The list of corrective measures alternatives is based on cleanup to the target risk-based MCSs (theoretical ILCR = 10^{-6} and HI = 1) or the

regulatory-based MCSs (MCLs), whichever is applicable. Cleanup to risk-based MCSs, which are less conservative than regulatory-based MCSs, is considered the short-term goal for areas where groundwater does not meet SWRCB criteria for potential drinking water sources (i.e., areas where well yield is less than 200 gallons per day). Cleanup to regulatory-based MCSs associated with protection of potential future drinking water sources is the short-term goal for areas where groundwater meets SWRCB criteria for potential drinking water sources (well yield is 200 gallons per day or greater) and is a long-term goal for all areas of Berkeley Lab. Regulatory compliance measures to prevent the migration of groundwater COCs to areas of uncontaminated groundwater or to surface water are applicable in all areas where migration is a potential threat.

The HHRA identified PCBs as the COC at two units, the Building 88 Hydraulic Gate Unit and the Building 75 Former Hazardous Waste Handling and Storage Facility. Subsequent to completion of the HHRA, Berkeley Lab conducted Interim Corrective Measures (ICMs) (soil excavation and offsite disposal) that resulted in reduction of residual PCB concentrations to less than the proposed MCS for PCBs of 1 mg/kg at both units. The MCS was set at the Toxic Substances Control Act (TSCA) (40 Code of Federal Regulations [CFR] Parts 750 and 761) self-implementing cleanup level of 1 mg/kg, for soil in high occupancy areas, which is both a risk-based and regulatory-based level. Verification sampling found compliance with this level, which is consistent with unrestricted future land use. No additional corrective action is therefore recommended for either of these units.

Recommended Corrective Measures Alternatives

Unit	Potential Human Receptors and Risk-Based Exposure Pathways of Concern[a]	Chemicals of Concern (COC)[d]	Recommended Corrective Measure Alternative for Cleanup[c]
Soil Units			
Building 51L Groundwater Plume Source Area	Future Indoor Worker (I) [b]	**PCE** **TCE** **chloroform** **vinyl chloride**	Excavation and offsite disposal.
AOC 6-3: Building 88 Hydraulic Gate Unit	Landscape Worker (I,F,D) Construction Worker (F,D)	none	No further action recommended. Excavation was completed to the Toxic Substances Control Act (TSCA) self implementing cleanup level as an Interim Corrective Measure (ICM) (See text paragraph preceding this table for description of ICM.)
AOC 2-5: Building 7 Sump	Future Indoor Worker(I) [b] Landscape Worker (I)	**PCE** **TCE** cis-1,2-DCE 1,1,1-TCA 1,1-DCA 1,1-DCE benzene **carbon tetrachloride** chloroform vinyl chloride	Excavation and offsite disposal.
SWMU 3-6: Building 75 Former Hazardous Waste Handling and Storage Facility	Landscape Worker (F,D) Construction Worker (F,D)	none	No further action recommended. (Excavation was completed to the TSCA self implementing cleanup level as an Interim Corrective Measure. (See text paragraph preceding this table for description of ICM.)

Recommended Corrective Measure Alternatives (cont'd.)

Unit	Potential Human Receptors and Risk-Based Exposure Pathways of Concern[a]	Chemicals of Concern (COC)[d]	Recommended Corrective Measure Alternative for Cleanup[c]
Groundwater Units			
AOC 9-13: Building 51/64 Groundwater Solvent Plume	Future Indoor Worker (I) [b]	TCE **PCE** **carbon tetrachloride** cis-1,2-DCE trans-1,2-DCE 1,1-DCE methylene chloride **1,1-DCA** 1,2-DCA **vinyl chloride** 1,1-TCA 1,1,2-TCA	In situ soil flushing combined with groundwater capture in plume source area. Monitored Natural Attenuation for downgradient portion of plume. Continued surface water (subdrain effluent) capture and treatment until groundwater discharge to surface water is shown to be below detectable levels.
Building 51L Groundwater Solvent Plume	Future Indoor Worker (I) [b]	**vinyl chloride**	Excavation and offsite disposal of saturated and unsaturated zone soils in the plume source zone. Monitored Natural Attenuation for remaining plume area. Reroute or line storm drain to prevent migration of groundwater COCs to surface water

Recommended Corrective Measure Alternatives (cont'd.)

Unit	Potential Human Receptors and Risk-Based Exposure Pathways of Concern[a]	Chemicals of Concern (COC)[d]	Recommended Corrective Measure Alternative for Cleanup[c]
Groundwater Units (cont'd.)			
AOC 1-9: Building 71 Groundwater Solvent Plume Building 71B lobe	Future Indoor Worker (I) [b]	TCE **PCE** cis-1,2-DCE vinyl chloride	The following combination of corrective measures alternatives is recommended for the plume source area: 1) excavation and offsite disposal of accessible shallow unsaturated zone soil, 2) limited in situ chemical oxidation of unsaturated zone soils adjacent to the building foundation, and 3) in situ soil flushing. For contaminated groundwater adjacent to the source area, enhanced bioremediation using Hydrogen Release Compounds (HRC) is the recommended measure. In addition, surface water (hydrauger effluent) capture and treatment will continue until groundwater discharge to surface water is shown to be below detectable levels.

Recommended Corrective Measure Alternatives (cont'd.)

Unit	Potential Human Receptors and Risk-Based Exposure Pathways of Concern[a]	Chemicals of Concern (COC)[d]	Recommended Corrective Measure Alternative for Cleanup[c]
Groundwater Units (cont'd.)			
AOC 2-4: Building 7 Lobe of the Old Town Groundwater Solvent Plume	Future Indoor Worker (I) [b] Construction Worker (D) Landscape Worker (I)	**TCE** **PCE** **carbon tetrachloride** cis-1,2-DCE trans-1,2-DCE 1,1-DCE chloroform methylene chloride 1,1-DCA 1,2-DCA 1,2-dichloropropane vinyl chloride 1,1,2-TCA benzene	The following combination of corrective measures alternatives is recommended for the different areas of the plume: 1) soil excavation (as described under AOC 2-5) for the plume source area; 2) continued in situ soil flushing combined with groundwater capture for the plume core area 4) Monitored Natural Attenuation (MNA) in the downgradient area, and 3) continued groundwater capture and treatment within and at downgradient edge of plume until groundwater concentrations are reduced to levels where downgradient migration of COCs above applicable MCSs or beyond the plume boundary would not occur without controls.
AOC 10-5: Building 52 Lobe of the Old Town Groundwater Solvent Plume	none	TCE PCE carbon tetrachloride cis-1,2-DCE	In situ soil flushing in contaminant source area. Continued capture and treatment at downgradient lobe boundary until groundwater discharge to surface water is shown to be below detectable levels.
AOC 10-5: Building 25A Lobe of the Old Town Groundwater Solvent Plume	none	TCE PCE carbon tetrachloride 1,1-DCE	In situ soil flushing in contaminant source area, Monitored Natural Attenuation for remainder of lobe area.

Recommended Corrective Measure Alternatives (cont'd.)

Unit	Potential Human Receptors and Risk-Based Exposure Pathways of Concern[(a)]	Chemicals of Concern (COC)[(d)]	Recommended Corrective Measure Alternative for Cleanup[(c)]
Groundwater Units (cont'd.)			
AOC 4-5: Solvents in Groundwater South of Building 76	none	none	No Action (COC concentrations are below risk-based MCSs and groundwater characteristics do not meet criteria of SWRCB Resolution 88-63 – *Sources of Drinking Water Policy*).
Support Services Area (Building 69A Area)	Future Indoor Worker (I) [(b)]	**vinyl chloride**	Monitored Natural Attenuation.
Support Services Area (Building 75/75A Area)	none	none	No Action (COC concentrations are below risk-based MCSs and groundwater characteristics do not meet criteria of SWRCB Resolution 88-63 – *Sources of Drinking Water Policy*).
Support Services Area (Building 77 Area)	none	none	No Action (COC concentrations are below risk-based MCSs and groundwater characteristics do not meet criteria of SWRCB Resolution 88-63 – *Sources of Drinking Water Policy*).
Benzene Detected in Wells East of Building 75A	none	none	No Action (COC concentrations are below risk-based MCSs and groundwater characteristics do not meet criteria of SWRCB Resolution 88-63 – *Sources of Drinking Water Policy*).

(a) I:Inhalation, F:Ingestion, D:Dermal Contact

(b) Current risks and/or hazards to indoor workers are within acceptable levels; future workers are those who might occupy future buildings located over plume areas.

(c) Recommended corrective measures based on cleanup to theoretical ILCR=10^{-6}, HI=1, and cleanup to address regulatory compliance issues

(d) Chemicals of Concern:

- Chemicals of Concern (COCs) for groundwater units where groundwater is a potential drinking water source are those VOCs that were detected at concentrations above Maximum Contaminant Levels (MCLs) for drinking water in fiscal year 2003 (FY03).
- COCs for groundwater units where groundwater is not a potential drinking water source are those VOCs that were detected at concentrations exceeding the target risk-based groundwater Media Cleanup Standard (MCS).
- COCs for soil units are those VOCS that were detected at concentrations exceeding the target risk-based soil MCS; and for those soil units where the underlying groundwater is a potential drinking water source, the groundwater COCs that have been detected in soil at the unit.
- Boldface concentrations indicate concentrations that exceed the relevant target risk-based MCS.

Cost estimates to achieve both risk-based cleanup levels and cleanup levels based on protection of potential future drinking-water sources are provided in the following table for each soil and groundwater unit. Although the target risk-based MCSs have been set at a theoretical ILCR of 10^{-6} and HQ of 1, estimated costs for cleanup to the upper-limit MCSs (theoretical ILCR = 10^{-4}, HI = 1) and to an intermediate level (theoretical ILCR = 10^{-5}, HI = 1) are also provided for comparison. Where cleanup to levels that are protective of potential drinking-water sources is not required, cost is shown as $0; however, risk-based cleanup and the associated costs shown will still be required for those areas. In addition, the incremental costs associated with controlling migration of contaminated groundwater are also provided, where applicable. Although these costs are indicated under regulatory compliance, if current migration control measures were terminated, there could also be a potential risk to the environment. The total costs of recommended corrective measures shown in the right-hand column of the table are based on the recommended level of cleanup (target risk-based MCSs or MCLs, whichever are applicable) and any recommended migration control measures.

This report also provides the required National Environmental Policy Act (NEPA) documentation, which includes a summary of the proposed RCRA corrective actions at Berkeley Lab and their consequences. The proposed corrective actions would not have significant direct, indirect, or cumulative effects on the human environment. The proposed actions would have the beneficial effect of improving soil and water quality by removing soil and groundwater contamination at the Berkeley Lab.

Cost Estimates for Specific Corrective Measures Alternatives Proposed for Soil and Groundwater Units

Soil and Groundwater Units	Risk-Based Cleanup Costs			Potential Future Drinking Water Source Cleanup Costs[a]	Regulatory Compliance Costs[b]	Total Costs[d] of Recommended Corrective Measures
	Risk = 10^{-4}	Risk = 10^{-5}	Risk = 10^{-6}	MCS = MCLs[c]	Incremental Cost of Migration Control	
Building 51/64 Groundwater Solvent Plume						
Corrective Measure	No Action	Soil Flushing and Extraction Trench and MNA.	Soil Flushing and Extraction Trench and MNA	Soil Flushing and Extraction Trench and MNA.	Capture and Treat Groundwater from Building 51 Subdrain	
Assumed End Date	N/A	Soil Flushing = 2011 MNA = indeterminate	Soil Flushing = 2011 MNA = indeterminate	Soil Flushing = 2011 MNA = indeterminate	indeterminate	
Capital Cost	$0	$29,000	$29,000	$29,000	$0	$29,000
Annual O&M Cost	$0	$106,000	$106,000	$106,000	$20,000	$126,000
Total Cost (NPV) through 2011	$0	$682,000	$682,000	$682,000	$124,000	$806,000
Annual Cost After 2011	$0	$26,000	$26,000	$26,000	$20,000	$46,000
Building 51L Groundwater Solvent Plume and Building 51L Source Area						
Corrective Measure	No Action	Soil Excavation and MNA.	Soil Excavation and MNA.	No Action	Reroute/line storm drain	
Assumed End Date	N/A	Excavation = 2006 MNA = indeterminate	Excavation = 2006 MNA = indeterminate	N/A	2006	
Capital Cost	$0	$569,000	$569,000	$0	$147,000	$716,000
Annual O&M Cost	$0	$26,000	$26,000	$0	$0	$26,000
Total Cost (NPV) through 2011	$0	$730,000	$730,000	$0	$138,000	$868,000
Annual Cost After 2011	$0	$26,000	$26,000	$0	$0	$26,000

Cost Estimates for Specific Corrective Measures Alternatives Proposed for Soil and Groundwater Units (cont'd.)

Soil and Groundwater Units	Risk-Based Cleanup Costs			Potential Future Drinking Water Source Cleanup Costs[a]	Regulatory Compliance Costs[b]	Total Costs[d] of Recommended Corrective Measures
	Risk = 10^{-4}	Risk = 10^{-5}	Risk = 10^{-6}	MCS = MCLs[c]	Incremental Cost of Migration Control	
Building 71 Groundwater Solvent Plume						
Corrective Measure	No Action	Chemical Oxidation (source area) and Soil Flushing	Chemical Oxidation (source area) and Soil Flushing	Chemical Oxidation (source area) and Soil Flushing	Capture and Treat Hydrauger Effluent	
Assumed End Date	N/A	Soil Flushing = 2011 Chemical Oxidation = 2006	Soil Flushing = 2011 Chemical Oxidation = 2006	Soil Flushing = 2011 Chemical Oxidation = 2006	indeterminate	
Capital Cost	$0	$380,000	$380,000	$380,000	$0	$380,000
Annual O&M Cost	$0	$80,000	$80,000	$80,000	$20,000	$100,000
Total Cost (NPV) through 2011	$0	$959,000	$959,000	$959,000	$124,000	$1,083,000
Annual Cost After 2011	$0	$0	$0	$0	$20,000	$20,000
Old Town Groundwater Solvent Plume Building 7 Lobe and Former Building 7 Sump						
Corrective Measure	Source Excavation, Soil Flushing and Groundwater Extraction,	Source Excavation, Soil Flushing and Groundwater Extraction	Source Excavation, Soil Flushing and Groundwater Extraction	Source Excavation, Soil Flushing and Groundwater Extraction, MNA in Downgradient Area	Capture and Treat Groundwater from Trenches	
Assumed End Date	2011	indeterminate	indeterminate	indeterminate	indeterminate	
Capital Cost	$591,000	$591,000	$591,000	$591,000	$0	$591,000
Annual O&M Cost	$62,000	$62,000	$62,000	$62,000	$20,000	$82,000
Total Cost (NPV) through 2011	$970,000	$970,000	$970,000	$970,000	$124,000	$1,094,000
Annual Cost After 2011	$0	$62,000	$62,000	$62,000	$20,000	$82,000

Cost Estimates for Specific Corrective Measures Alternatives Proposed for Soil and Groundwater Units (cont'd.)

Soil and Groundwater Units	Risk-Based Cleanup Costs			Potential Future Drinking Water Source Cleanup Costs[a]	Regulatory Compliance Costs[b]	Total Costs[d] of Recommended Corrective Measures
	Risk = 10^{-4}	Risk = 10^{-5}	Risk = 10^{-6}	MCS = MCLs[c]	Incremental Cost of Migration Control	
Old Town Groundwater Solvent Plume Building 52 Lobe						
Corrective Measure	No Action	No Action	No Action	Soil Flushing with 4 New Injection Wells	Capture and Treat Groundwater from B46 Subdrain	
Assumed End Date	N/A	N/A	N/A	indeterminate	indeterminate	
Capital Cost	$0	$0	$0	$66,000	$0	$66,000
Annual O&M Cost	$0	$0	$0	$49,000	$20,000	$69,000
Total Cost (NPV) through 2011	$0	$0	$0	$364,000	$124,000	$488,000
Annual Cost After 2011	$0	$0	$0	$49,000	$20,000	$69,000
Old Town Groundwater Solvent Plume Building 25A Lobe						
Corrective Measure	No Action	No Action	No Action	Soil Flushing and Groundwater. Extraction, MNA in Downgradient Area	No Action	
Assumed End Date	N/A	N/A	N/A	indeterminate	N/A	
Capital Cost	$0	$0	$0	$0	$0	$0
Annual O&M Cost	$0	$0	$0	$51,000	$0	$51,000
Total Cost (NPV) through 2011	$0	$0	$0	$318,000	$0	$318,000
Annual Cost After 2011	$0	$0	$0	$51,000	$0	$51,000

Cost Estimates for Specific Corrective Measures Alternatives Proposed for Soil and Groundwater Units (cont'd.)

Soil and Groundwater Units	Risk-Based Cleanup Costs			Potential Future Drinking Water Source Cleanup Costs[a]	Regulatory Compliance Costs[b]	Total Costs[d] of Recommended Corrective Measures
	Risk = 10^{-4}	Risk = 10^{-5}	Risk = 10^{-6}	MCS = MCLs[c]	Incremental Cost of Migration Control	
Solvents in Groundwater South of Building 76						
Corrective Measure	No Action	No Action	No Action	No Action	No Action	
Assumed End Date	N/A	N/A	N/A	N/A	N/A	
Capital Cost	$0	$0	$0	$0	$0	$0
Annual O&M Cost	$0	$0	$0	$0	$0	$0
Total Cost (NPV)	$0	$0	$0	$0	$0	$0
Building 75/75A Area of Groundwater Contamination						
Corrective Measure	No Action	No Action	No Action	No Action	No Action	
Assumed End Date	N/A	N/A	N/A	N/A	N/A	
Capital Cost	$0	$0	$0	$0	$0	$0
Annual O&M Cost	$0	$0	$0	$0	$0	$0
Total Cost (NPV)	$0	$0	$0	$0	$0	$0
Building 69A Area of Groundwater Contamination						
Corrective Measure	No Action	No Action	MNA	No Action	No Action	
Assumed End Date	N/A	N/A	indeterminate	N/A	N/A	
Capital Cost	$0	$0	$0	$0	$0	$0
Annual O&M Cost	$0	$0	$26,000	$0	$0	$26,000
Total Cost (NPV) through 2011	$0	$0	$160,000	$0	$0	$160,000
Annual Cost After 2011	$0	$0	$26,000	$0	$0	$26,000

Cost Estimates for Specific Corrective Measures Alternatives Proposed for Soil and Groundwater Units (cont'd.)

Soil and Groundwater Units	Risk-Based Cleanup Costs			Potential Future Drinking Water Source Cleanup Costs[a]	Regulatory Compliance Costs[b]	Total Costs[d] of Recommended Corrective Measures
	Risk = 10^{-4}	Risk = 10^{-5}	Risk = 10^{-6}	MCS = MCLs[c]	Incremental Cost of Migration Control	
Building 77 Area of Groundwater Contamination						
Corrective Measure	No Action	No Action	No Action	No Action	No Action	
Assumed End Date	N/A	N/A	N/A	N/A	N/A	
Capital Cost	$0	$0	$0	$0	$0	$0
Annual O&M Cost	$0	$0	$0	$0	$0	$0
Total Cost (NPV)	$0	$0	$0	$0	$0	
Benzene in Wells East of Building 75A						
Corrective Measure	No Action	No Action	No Action	No Action	No Action	
Assumed End Date	N/A	N/A	N/A	N/A	N/A	
Capital Cost	$0	$0	$0	$0	$0	$0
Annual O&M Cost	$0	$0	$0	$0	$0	$0
Total Cost (NPV)	$0	$0	$0	$0	$0	
Building 88 Hydraulic Gate Unit						
Corrective Measure	No Action	No Action	No Action	No Action	No Action	
Assumed End Date	N/A	N/A	N/A	N/A	N/A	
Capital Cost	$0	$0	$0	N/A	$0	$0
Annual O&M Cost	$0	$0	$0	N/A	$0	$0
Total Cost (NPV) through Assumed End Date	$0	$0	$0	$0	$0	$0

Cost Estimates for Specific Corrective Measures Alternatives Proposed for Soil and Groundwater Units (cont'd.)

Soil and Groundwater Units	Risk-Based Cleanup Costs			Potential Future Drinking Water Source Cleanup Costs[a]	Regulatory Compliance Costs[b]	Total Costs[d] of Recommended Corrective Measures
	Risk = 10^{-4}	Risk = 10^{-5}	Risk = 10^{-6}	MCS = MCLs[c]	Incremental Cost of Migration Control	
Building 75 Former Hazardous Waste Handling and Storage Facility						
Corrective Measure	No Action	No Action	No Action	No Action	No Action	
Assumed End Date	N/A	N/A	N/A	N/A	N/A	
Capital Cost	$0	$0	$0	N/A	$0	$0
Annual O&M Cost	$0	$0	$0	N/A	$0	$0
Total Cost (NPV) through Assumed End Date	$0	$0	$0	$0	$0	$0
Grand Total (NPV) through 2011	$970,000	$3,341,000	$3,501,000	$3,293,000	$634,000	$4,817,000[e]
Grand Total (Annual Cost After 2011)	$0	$114,000	$140,000	$188,000	$80,000	$320,000[e]

(a) Where regulatory-based cleanup is not required, the cost for regulatory-based cleanup is shown as $0.00; however, risk-based cleanup and the associated costs shown will still be required for those areas.

(b) Control the migration of contaminated groundwater so that COCs do not migrate to groundwater in adjacent uncontaminated areas or to surface water.

(c) Regulatory-based MCSs apply in plume areas where well yield ≥ 200 gallons per days

(d) Total costs only include estimated direct costs associated with task scopes described in the CMS report. General compliance costs and program administration/management costs are not included.

(e) The Total Costs of Recommended Corrective Measures (column 7) is the sum of either the Risk Based Cleanup Cost (column 4) or the Potential Drinking Water Source Cleanup Cost (column 5), whichever is applicable at each unit, and the Regulatory Compliance Cost (column 6). Therefore the Total Costs of Recommended Corrective Measures does not sum across each row.